

NOTEWORTHY RECORDS OF SMALL MAMMALS FROM
GHANA WITH SPECIAL EMPHASIS ON THE ACCRA PLAINSJAN DECHER¹DUANE A. SCHLITTER
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ABSTRACT

In this paper we describe new or additional records of four species of shrews (Soricidae), nine species of bats (Hipposideridae, Vespertilionidae, Molossidae), and one species of rodent (Muridae) from Ghana. These records add to our knowledge of the distribution of small mammals in Ghana especially those occurring on the Accra Plains. A zoogeographic explanation for these distributional data is sought in the context of the Dahomey Gap phenomenon.

INTRODUCTION

Little information has been published during the last three decades on the distribution and systematics of Ghanaian mammals. The most recent effort of documenting populations of terrestrial mammals in southern Ghana was that by Yeboah (1984), who studied the ecology of small rodents in primary forest and farmland at Kukurantumi near Koforidua, southeastern Ghana, and was the first to report *Steatomys cuppedius* from an area south of the Guinea savanna. To date, our knowledge of Ghanaian shrews, bats, rodents, and small carnivores is patchy, if not anecdotal, throughout much of the region. A comprehensive review of the mammals of Ghana is badly needed.

This paper reports new records of small mammals from Ghana. These records augment those previously mentioned in checklists of Ghanaian mammals (Ingoldby, 1929; Cansdale, 1948; Booth, 1956, 1959) and the relevant chapters in Mammal Species of the World (Wilson and Reeder, 1993) or considerably extend the known range for these species in Ghana. Additional species are added to the list of forest and savanna mammals peculiar to the Dahomey Gap, the conspicuous interruption of the West African high forest belt in the region of southeastern Ghana, Togo, and Benin. Jeník (1984, 1994) interpreted the Dahomey Gap phenomenon as a result of cooler offshore upwellings near Cape Palmas, Liberia, and Cape Three Points, Ghana. On the Accra Plains, this coastal upwelling leads to abnormally arid climate with characteristic dry forest or savanna vegetation types (Jeník and Hall, 1976). The Accra Plains have also been termed the "core area" of the Dahomey Gap (Jeník, 1994:130) with a mean annual rainfall from just 733

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mm (Accra) to 1117 mm (Akuse). The mixture of savanna and forest mammalian faunal elements in the Dahomey Gap was first discussed by Booth (1954, 1958, 1959) and later reevaluated by Robbins (1978).

MATERIALS AND METHODS

Specimens were collected between October 1991 and June 1992 as part of a study of small mammal ecology on the Accra Plains of Ghana (Fig. 1; Appendix). Most terrestrial mammals were collected on 1-ha trapping grids with 100 stations each supplied with two Sherman live traps. In addition, Museum Special snap traps were used during a field trip to the area of Yendi and Bimbila, northeastern Ghana, in November 1991. Bats were collected with mist nets. The *Otomops* specimen collected in 1968 and catalogued at the United States National Museum of Natural History (USNM), Washington, D.C., (USNM 420099) was included because until recently this bat was known only from East and South Africa (Long, 1995). All other specimens, including frozen tissues for future examination, are housed at the Carnegie Museum of Natural History (CM), Section of Mammals, Pittsburgh, Pennsylvania, and the J. F. Bell Museum of Natural History at the University of Minnesota (MMNH), Saint Paul, Minnesota. A synoptic collection was returned to the Ghana Department of Game and Wildlife, Accra.

External measurements were recorded in the field to the nearest millimeter. Cranial measurements were obtained with digital calipers to the nearest 0.1 mm. Mensural variates for the shrews were: total length; head, body and tail; tail; hindfoot; ear; mass (g); condylo-incisive length of the skull; least intraorbital width; greatest maxillary breadth; greatest width of braincase; greatest height of braincase; and greatest length of upper tooth row, following Hutterer and Happold (1983). In addition, for bats we used: forearm, condylo-canine length, width across last molar, and length of maxillary tooth row (C-M³), following Qumsiyeh (1985) and Koopman (1975); and for rodents: upper cheekteeth row, and zygomatic breadth following Van der Straeten and Verheyen (1978). Nomenclature follows Wilson and Reeder (1993), unless otherwise noted.

TAXONOMIC ACCOUNTS

Insectivora

Family Soricidae

Crocidura buettikoferi Jentink, 1888

This is a medium shrew with dark brown dorsal fur and slightly paler grayish-brown ventral pelage. The tail is covered with very short hairs and a few scattered bristles. Only one female was collected on 12 February 1992 at Adumanya Sacred Grove—a traditionally protected 1.5-ha remnant of high forest, near Dodowa, at the foot of the Akwapim escarpment on the northwestern Accra Plains (Fig. 1; Table 1). This grove is surrounded by farmland. The female was pregnant with a single embryo each in the left and right uterine horns.

Hutterer and Happold (1983:49) stated that, in Nigeria, "According to collectors' notes, *C. buettikoferi* lives in grassland habitats in the rainforest zone rather than in forest habitats." However, we collected our specimen in a high forest habitat. This species has not been reported previously from Ghana (Hutterer, 1993), and attempts to collect it in the Ivory Coast failed (Heim de Balsac, 1968), even though its type specimen is from Robertsport, Liberia (Jentink, 1888).

Crocidura crossei Thomas, 1895

This is a pale, grayish shrew with a light gray ventral pelage contrasting with darker dorsal fur. The tail bristles are more dense than in *C. buettikoferi*. Four

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Fig. 1.—Map of the Accra Plains and Ghana (insert) showing collecting localities mentioned in the text.

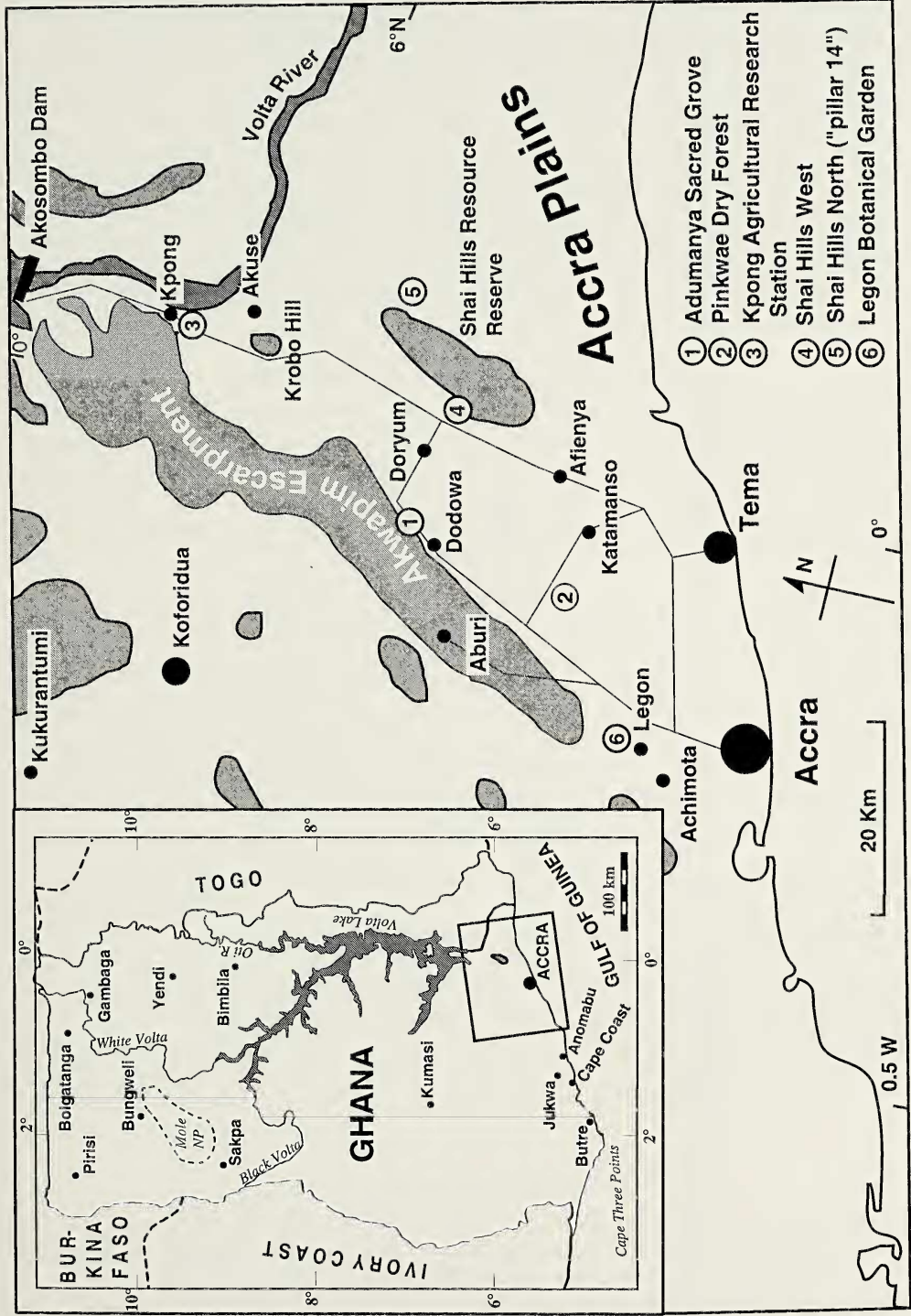


Table 1.—Selected external and cranial measurements (mm; $\bar{x} \pm SD$ [range]) of *Crocidura buettikoferi* and *C. crossei*. Sample sizes are given in parentheses in column headings. Raw measurements are given for samples of 1–2 specimens; summary statistics are limited to ranges for the sample of *C. buettikoferi* from Nigeria.

Variate	<i>Crocidura buettikoferi</i>			<i>Crocidura crossei</i>		
	Nigeria		Ghana	Ghana		Nigeria
	Females (1) ^a	Females (3) ^b		Females (4) ^c	Males (5) ^d	Both sexes (10) ^b
Total length	142	—	117.0 $\pm$ 1.83 (115–119)	116.6 $\pm$ 3.44 (114–122)	—	—
Tail length	52	51–62	47.8 $\pm$ 2.22 (45–50)	48 $\pm$ 3.24 (45–51)	48–57	48–57
Hindfoot length	14	12–15	12.3 $\pm$ 0.5 (12.0–13.0)	12.2 $\pm$ 1.09 (11.0–13.0)	10–12	10–12
Ear length	13	7.0–9.5	9.8 $\pm$ 1.5 (8.0–11)	9.8 $\pm$ 1.3 (8.0–11.0)	6–8	6–8
Mass (g)	10	—	5.1 $\pm$ 0.75 (4.5–6.0)	5.6 $\pm$ 0.89 (5.0–7.0)	6.3–8.0	6.3–8.0
Condylar-incisive length	21.9	21.4–22.7	18.8 $\pm$ 0.79 (18.1–19.6)	18.7 $\pm$ 0.58 (17.9–19.4)	18.5–19.9	18.5–19.9
Intraorbital width	4.5	4.9–5.1	3.6 $\pm$ 0.13 (3.4–3.7)	3.7 $\pm$ 0.08 (3.6–3.8)	4.0–4.4	4.0–4.4
Greatest maxillary breadth	7.2	6.7–7.1	5.7 $\pm$ 0.32 (5.3–5.9)	5.7 $\pm$ 0.18 (5.5–5.9)	5.5–6.0	5.5–6.0
Width of skull	9.8	9.2–9.9	7.8 $\pm$ 0.26 (7.5–8.1)	8.0 $\pm$ 0.21 (7.7–8.2)	7.8–8.5	7.8–8.5
Height of braincase	5.4	5.2–5.8	4.1 $\pm$ 0.19 (3.9–4.3)	4.3 $\pm$ 0.31 (3.9–4.6)	4.4–4.7	4.4–4.7
Upper tooth row	9.8	10.0–10.1	8.1 $\pm$ 0.28 (7.9–8.5)	8.0 $\pm$ 0.27 (7.7–8.3)	7.7–8.6	7.7–8.6

^a Specimen CM 113501.

^b After Huarter and Hapold (1983).

^c Specimens CM 113503, 113505, 113507, and 113508.

^d Specimens CM 113502, 113504, 113506, 113509, and 113510.

females and four males of this shrew were captured during the dry season, between 3–5 December 1991, at Pinkwae Dry Forest, another 120-ha sacred grove on the Accra Plains. A single male was caught in a *Gmelina* forest plantation near the University of Ghana Agricultural Research Station at Kpong (Fig. 1; Table 1). Both are relatively undisturbed forests surrounded by savanna and farmland. Only one of the four females captured at Pinkwae was pregnant with two embryos, one in each uterine horn.

In western Nigeria this species occurred throughout the “rainforest zone, and relic forests in derived savanna . . .” (Hutterer and Happold, 1983:62). The occurrence in a sacred grove and a tree plantation on the Accra Plains may point to a less specialized distribution requiring closed canopy forests of a variety of types including the unique dry “south-east outlier type” of the Accra Plains (Hall and Swaine, 1981:87).

Crocidura lamottei Heim de Balsac, 1968

This is a medium-sized shrew with lighter colored pelage. The gray venter is washed with a yellowish tint and contrasts with the gray-brown dorsal fur. The tail has densely arranged short bristles. The hindfoot is very short. The vibrissae are long and the ears small. Two females were caught at Pinkwae Dry Forest on the Accra Plains on 17 and 26 November 1991, during the beginning of the dry season (Table 2). The latter one was pregnant with one embryo in the left uterine horn.

In size these specimens are slightly larger than specimens from Guinea, Ivory Coast, and Togo reported by Heim de Balsac (1968) in his description of the species. They agree more closely with three individuals reported by Hutterer and Happold (1983) from southwestern Nigeria, and with the specimens from Senegal, Burkina Faso, and northern Nigeria which Hutterer (1986) included in the subspecies *C. lamottei elegans*. The species is now known from a variety of habitats, including rainforest (Korup National Park; Hutterer and Schlitter, 1996), clearings in the forest zone (Owerri, Nigeria; Hutterer, 1986), Guinea savanna (Mt. Nimba, Guinea, and Ivory Coast; Heim de Balsac, 1968), and Sudan savanna (Bandia, Senegal; Hutterer, 1986).

The new specimens constitute the second record of Lamotte’s shrew from southern Ghana. Hutterer (1986) recorded it from Achimota, Accra Plains. His manuscript listed two other localities from Ghana, Legon and Pinkwae, but these were lost apparently during the publishing process. Skulls extracted from owl pellets from these three localities are deposited in the collections of the Museum Alexander Koenig, Bonn, Germany. Other specimens from Ghana were from Kokofu, Brong Ahafo Region (USNM 424636), and Pulima, Upper West Region (USNM 414681). According to present knowledge the range of *C. lamottei* extends across most of the savannas of West Africa but nowhere as close to the coast as on the Accra Plains.

Crocidura nigeriae Dollman, 1915

Crocidura nigeriae is not quite as dark brown as *C. buettikoferi*, with a few distinct long bristles on the tail. The dorsal fur has a slightly grizzled appearance. This species was caught only at Yendi and Bimbila in the Northern Region of northeastern Ghana (Table 2). These specimens are the first records of this species west of Nigeria.

Table 2.—Selected external and cranial measurements (mm; $\bar{x} \pm SD$ [range]) of *Crocidura lamotteti* and *C. nigeriae*. Sample sizes are given in parentheses in column headings. Raw measurements are given for samples of 1–2 specimens; summary statistics are limited to ranges for the sample of *C. nigeriae* from Ghana.

Variate	<i>Crocidura lamotteti</i>				<i>Crocidura nigeriae</i>			
	Ghana		Guinea, Ivory Coast, Togo		Ghana		Nigeria	
	Females (2) ^a	Males (2), females (1) ^b	Both sexes (5–9) ^c		Females (4) ^d	Males (3) ^e	Ilashe Males (3) ^f	Asaba Holotype ^g
Total length	138, 140	—	—		156 $\pm$ 5.94 (148–161)	159 $\pm$ 13.5 (144–170)	—	—
Tail length	51, 46	52–55	35.5–52.0 (5)		60.3 $\pm$ 2.63 (58–64)	56.7 $\pm$ 4.0 (53–61)	64–69	67
Hindfoot length	14, 14	15–16	14.0–15.5 (5)		17 $\pm$ 0.82 (16–18)	17 $\pm$ 1 (16–18)	18	15.5
Ear length	10, 12	11–12	—		10 $\pm$ 0.82 (9–11)	11.3 $\pm$ 2.5 (9–14)	10–11	9.5
Mass (g)	17.5, 11.0	18–23	—		15.3 $\pm$ 3.5 (11–19)	20.3 $\pm$ 4.7 (15–24)	6.3–8.0	—
Condyllo-incisive length	26.8, 25.2	24.7–25.8	25.5–26.0 (7)		25.1 $\pm$ 0.6 (24.3–25.7)	25.8 $\pm$ 1.2 (24.4–26.6)	24.7–25.5	25.9
Intraorbital width	4.9, 4.8	4.7–5.4	4.7–5.0 (8)		4.9 $\pm$ 0.3 (4.6–5.3)	4.9 $\pm$ 0.2 (4.7–5.0)	5.2–5.4	5.1
Maxillary breadth	8.2, 8.4	8.1–8.8	7.8–8.5 (8)		7.9 $\pm$ 0.31 (7.6–8.3)	8.1 $\pm$ 0.4 (7.6–8.3)	7.8	7.8
Width of skull	10.7, 10.5	10.1–10.6	—		10.6 $\pm$ 0.3 (10.1–10.4)	10.7 $\pm$ 0.5 (10.3–11.3)	10.5–10.7	10.5
Height of brain case	5.9, 5.7	5.7–6.2	5.7–6.0 (7)		5.9 $\pm$ 0.2 (5.7–6.0)	6.1 $\pm$ 0.2 (5.9–6.2)	5.8–6.2	6.8
Upper tooth row	11.9, 11.4	11.1–11.5	10.4–11.8 (9)		11.3 $\pm$ 0.2 (11.0–11.5)	11.6 $\pm$ 0.4 (11.2–12.0)	10.6–11.1	11.5

^aSpecimens CM 113511, 113512.

^bAfter Hutterer and Happold (1983).

^cAfter Heim de Balsac (1968).

^dSpecimens CM 113516, 113517, 113518, 113519.

^eSpecimens CM 113513, 113514, 113515.

^fAfter Dollman (1915).

Table 3.—Selected external and cranial measurements (mm; $\bar{x} \pm SD$ [range]) for *Hipposideros abae*. Sample sizes are given in parentheses in column headings. Raw measurements are given for samples of 1–2 specimens; summary statistics are limited to ranges for the sample of female *H. abae* from Anamabu, Ghana.

Variate	Ghana			Burkina Faso	Cameroon
	Pinkwae Forest	Anamabu		Diebougou	Karba Manga
	Females (2) ^a	Females (3) ^b	Males (2) ^c	Males (2) ^d	Males (1) ^e
Total length	105, 99	—	—	—	—
Tail length	30, 34	35 $\pm$ 4.36 (30–38)	35, 34	35, 31	31
Hindfoot length	13, 13	11 $\pm$ 0.0 (11)	10.5, 10.0	6.5, 9.0	10
Ear length	21, 22	21.3 $\pm$ 1.15 (20–22)	18.5, 19.0	22, 21	20
Mass (g)	25.5, 20.0	—	—	—	—
Forearm length	59.7, 60.0	59.67 $\pm$ 1.15 (59–61)	61, 60	57.0, 55.5	58
Condylar-canine length	19.2, 19.1	—	—	—	20
Width across molars	8.9, 9.0	—	—	8.85, 8.50	9.1
C–M ³	8.7, 8.8	9.17 $\pm$ 0.29 (9.0–9.5)	9, 9	8.9, 9.0	8.9

^a Specimens CM 113596, 113597.

^b After Hayman (1945); specimens BM 46.108, 46.109, 46.233.

^c After Hayman (1945); specimens BM 46.107, 46.232.

^d After Koch-Weser (1984); SMF 60987, 60988.

^e After Aellen (1952); no. 1261.

Hutterer and Happold (1983:51) report this species as “widespread in rainforest zone and parts of derived savanna,” while we found it only in the northern Guinea savanna in Ghana. Previously regarded as a subspecies of *C. poensis* (Heim de Balsac and Meester, 1977), this shrew was subsequently recognized as a separate species on the basis of its different karyotype— $2n = 50$, $FN = 76$ versus $2n = 52$, $FN = 70$ in *C. poensis* (Meylan and Vogel, 1982).

Chiroptera

Family Hipposideridae

Hipposideros abae J. A. Allen, 1917

Two females were caught at Pinkwae Forest, Accra Plains, on 10 and 15 April 1992. Both are of the bright orange color phase mentioned by Rosevear (1965) and Happold (1987). This species has not been reported from the Accra Plains before, but Hayman (1945) gives measurements for two males and three females from Anamabu, Cape Coast, Ghana, housed at the Natural History Museum, London (BMNH). These and a female with the locality “Anomabu,” Central Region, Ghana, at the Field Museum of Natural History (FMNH), Chicago, Illinois (FMNH 54495), were collected by G. S. Cansdale in 1945. There is also one male at the USNM (USNM 414239), collected by J. C. Geest at Butre in the Western Region, and another male specimen from Mole National Park, “near Bungweli” in the Northern Region of Ghana (cf. Fig. 1), at the American Museum of Natural History (AMNH), New York (AMNH 237421). In a comparison of measurements (Table 3), the Accra Plains specimens agree well with those published from Anamabu (Hayman, 1945), two Burkina Faso specimens (Koch-Weser, 1984), and one Cameroon specimen (Aellen, 1952). In Burkina Faso, *H. abae* was found roosting in association with *H. caffer*, *H. jonesi*, *Rhinolophus landeri*,

and *Lissonycteris angolensis* in a subterranean bunker (Koch-Weser, 1984). In his checklist of Gold Coast mammals, Cansdale (1948) notes that *H. abae* was found together with *H. caffer guineensis* inside Anamabu Castle. This bat is relatively rare and has a wide distribution from Guinea Bissau to Uganda (Hill, 1963; Rosevear, 1965).

Family Vespertilionidae
Eptesicus guineensis (Bocage, 1889)

Rosevear (1965) pointed to the deep chestnut-brown color as one characteristic of this dark-winged *Eptesicus*. Two males and four females were caught. Two of the females, taken on 2 November 1991 at Bimbila in the Northern Region, were lactating. All the others were caught on the Accra Plains. One male was netted at the University of Ghana, Legon, Botanical Garden, on 14 November 1991; a male and female were captured at a waterhole in the northeastern Shai Hills Resource Reserve on 13 January and 6 May 1992, respectively; and on 19 May 1992, one individual was caught at the southwestern end of the Shai Hills Resource Reserve (Fig. 1; Table 4). Koch-Weser (1984) pointed out the sexual dimorphism (females are larger) in this species.

This bat occurs from Senegal to Ethiopia and northeastern Zaire. It was reported from several localities in Burkina Faso (Koopman et al., 1978; Koch-Weser, 1984) and seems to occur throughout the savanna zones of Ghana. There is one additional specimen from Subinja, 2 mi E Wenchi, Brong Ahafo Region, at the USNM (USNM 414983). It appears that this bat inhabits the various savanna types of West Africa, reaching the coast where vegetation and climate permit, as on the Accra Plains, or at Conakry, Guinea (Rosevear, 1965).

Eptesicus capensis (A. Smith, 1829)

All four individuals of this species were captured at two waterholes in the northeast and northwest portions of the Shai Hills Resource Reserve on the Accra Plains. Two females and one male were caught on 12 November 1991 and one female with two embryos was netted on 13 January 1992. Measurements (Table 4) are compared to those from Sudan (Rosevear, 1965; Koopman, 1975; McLellan, 1986).

Eptesicus capensis is even more widespread in Africa than *E. guineensis*. The occurrence on the Accra Plains extends its range to the coastal savanna. Two specimens were reported from Aledjo and Niamtougou, northern Togo, by De Vree et al. (1970). These records indicate that this bat probably occurs throughout the "Dahomey Gap" region, thus confirming Rosevear (1965:257) who stated that "bats assignable to this species may therefore be expected throughout West Africa and in all zones, though possibly more commonly in the forest and Guinea woodlands, and perhaps not at all in the Sahara."

Pipistrellus aegyptius (Fischer, 1829)

A single specimen was caught at the "Pillar 14" waterhole in the Shai Hills Resource Reserve (Table 5). This is the first record of this species south of the West African Guinea Woodland. Geographically, the next closest record is a male from Nobéré, Burkina Faso (Koopman et al., 1978, as *P. deserti* Thomas, 1902). This latter specimen is housed at the Royal Ontario Museum (ROM), Toronto, Canada, and has a forearm length of only 25.9 mm (Qumsiyeh, 1985).

Table 4.—Selected external and cranial measurements (mm; $\bar{x} \pm SD$ [range]) of *Eptesicus guineensis* and *E. capensis*. Sample sizes are given in parentheses in column headings. Raw measurements are given for samples of 1–2 specimens; summary statistics are limited to ranges for specimens from Ghana.

Variate	<i>Eptesicus guineensis</i>				<i>Eptesicus capensis</i>			
	Ghana		Burkina Faso ^c		Ghana		Sudan	
	Females (4) ^a	Males (2) ^b	Females (2)	Males (1)	Guinea ^d	Females (3), males (1) ^e	(n) ^f	West African localities ^g
Total length	77.8 $\pm$ 2.8 (75–81)	71, 77	—	—	—	79.3 $\pm$ 3.1 (75–82)	—	—
Tail length	29.8 $\pm$ 5.2 (22–33)	25, 31	32.0, 33.5	30	25	28.8 $\pm$ 3.95 (23–32)	27.5 (26–29) (2)	28–38
Hindfoot length	6.4 $\pm$ 0.8 (6.0–7.5)	7, 6	—	—	—	6 $\pm$ 0 (6)	—	—
Ear length	9.0 $\pm$ 1.2 (8–10)	9, 10	9.0, 10.5	9.3	9	9.5 $\pm$ 1.7 (7.0–11.0)	11.5 (11–12) (2)	—
Mass (g)	3.8 $\pm$ 0.5 (3.0–4.0)	4, 3	—	—	—	4 $\pm$ 0 (4)	2.5–4.0 (6)	—
Forearm length	28.5 $\pm$ 0.96 (27.5–29.6)	27.9, 26.3	26.2, 29.1	26.7	26	28.7 $\pm$ 0.5 (28.2–29.3)	28–33 (11)	29–36
Condylar length	11.0 $\pm$ 0.3 (10.6–11.2)	10.7, 10.7	10.7	10.5	11	11.5 $\pm$ 0.3 (11.2–11.6)	12.0–12.6 (4)	12.5–14.9
Width across molars	4.8 $\pm$ 0.2 (4.5–5.0)	4.9, 4.7	—	—	—	5.3 $\pm$ 0.0 (5.3)	5.2–5.7 (4)	5.2–6.3
C–M ³	4.0 $\pm$ 0.2 (3.7–4.2)	3.7, 3.9	3.7	3.65	3.5	4.3 $\pm$ 0.1 (4.2–4.4)	4.1–4.4 (4)	4.5–5.5

^aSpecimens CM 113618, 113619, 113621, 113622.

^bSpecimens CM 113617, 113620.

^cAfter Koch-Weser (1984).

^dAfter Rosevear (1965); type specimen.

^eSpecimens CM 113613, 113614, 113615, 113616.

^fCombined after Koopman (1975) and McLellan (1986).

^gAfter Rosevear (1965).

Table 5.—Selected external and cranial measurements (mm; $\bar{x} \pm SD$ [range]) of *Pipistrellus aegyptius* and *P. nanulus*. Sample sizes are given in parentheses. Raw measurements are given for samples of 1–2 specimens; summary statistics are limited to ranges for the sample of *P. nanulus* from Ghana.

Variate	<i>Pipistrellus aegyptius</i>				<i>Pipistrellus nanulus</i>			
	Ghana	Algeria	Libya	Ghana	West African localities ^c	East Africa ^d		
	Shai Hills	Beni Abbes	Fezzan					
	Males (1) ^a	Females (2), males (2) ^b	Males (1) ^e					Females (3), males (1) ^f
Total length	80	—	—	67.8 ± 2.06 (65–69)	—	—	—	
Tail length	34	34–37	33	23 ± 1.4 (21–24)	25.0–27.5	21–25	—	
Hindfoot length	8	6.0–7.0	6.2	6.1 ± 1.2 (4.5–7.0)	—	—	—	
Ear length	10	11.0–12.5	10	9.5 ± 1.0 (8.0–10.0)	—	—	—	
Mass (g)	3	—	—	4 ± 0.4 (3.5–4.5)	—	5.0–5.5	—	
Forearm length	30.5	31.5–33.0	29.5	26.2 ± 0.91 (24.9–27.0)	25.5–31.0	21–25	—	
Condylo-canine length	11.1	11.6–12.4	11.0	10.2 ± 0.4 (9.9–10.8)	—	—	—	
Width across molars	4.9	—	—	4.7 ± 0.1 (4.6–4.8)	5.0–5.3	—	—	
C-M ³	4.1	4.3–4.6	4.2	3.6 ± 0.3 (3.1–3.8)	3.9–4.0	—	—	

^a Specimen CM 113631.

^b After Qumsiyeh (1985).

^c After Qumsiyeh (1985) (holotype of *P. deserti*).

^d Specimens CM 113632, 113633, 113634, and 113635.

^e After Rosevear (1965).

^f After Kingdon (1974).

Pipistrellus nanulus Thomas, 1904

All four specimens were caught in the north of Shai Hills Resource Reserve at the edge of a man-made waterhole (Table 5). Two females caught on 18 and 23 January 1992 carried two and one embryos, respectively. This species has the shortest forearm of all bats caught in the study, although slightly larger than the 21–25 mm range reported in Kingdon (1974).

This tiny bat is known from the high forest zone from Sierra Leone to Kenya and Bioko (De Vree et al., 1969; Jones, 1971; Happold, 1987; Koopman, 1993). Single specimens were reported from Mount Nimba, Liberia (Wolton et al., 1982), and from Ahoué-Ahoué, Togo (De Vree et al., 1969) but no measurements were given.

Nycticeinops schlieffeni (Peters, 1859)

Only one female with light brown dorsal fur, beige-colored ventral pelage, and a lancet-shaped tragus was caught at the waterhole in the northern Shai Hills Resource Reserve (Table 6). We follow Hill and Harrison (1987) regarding the generic name of this bat, distinguishing it from the American *Nycticeius humeralis* on the basis of the morphology of its baculum. This savanna species was previously known from the “Fra-fra Country” on the White Volta, where it was “found in huts” (de Winton, 1899:355; Rosevear, 1965) and also from Gambaga in north-eastern Ghana (Ingoldby, 1929) but it has never been reported from anywhere in southern Ghana. Specimens of *N. schlieffeni albiventer* have been reported from Paio and Fazao, Togo (De Vree et al., 1969, 1970) and several localities in Burkina Faso (Koopman et al., 1978; Koch-Weser, 1984) but all previous records in the region were from localities north of 8°N latitude in West Africa. *Nycticeinops schlieffeni* ranges widely from Mauritania eastward “to Egypt, the Sudan, Somalia, and southwestern Arabia, thence through much of eastern Africa to Mozambique, South Africa, Botswana, and Namibia” (Hill, 1983:56f). There are currently two karyotypes recognized under the name *N. schlieffenei*, $2n = 42$ and $FN = 50$ for 22 specimens from southern Africa (Rautenbach et al., 1993) and $2n = 34$ and $FN = 52$ for one specimen from Somalia (Ruedas et al., 1990).

Scotoecus albofuscus Thomas, 1890

This bat has not previously been reported from Ghana but is known in West Africa from Gambia, Senegal, Sierra Leone, Ivory Coast, and Nigeria (Hill, 1974). However, there are also specimens from Doryum on the Accra Plains in the collection of the Royal Ontario Museum (ROM), Canada (W. F. H. Ansell, personal communication). The four new specimens from Ghana were collected in the open savanna near a waterhole at the northeastern Shai Hills Resource Reserve. The female, netted on 13 January 1992, was not reproductively active (Table 6). Very little is known about the natural history of this species. Specimens from Nigeria were also caught “near a marsh” and “close to the water” (Happold, 1987:68).

Myotis bocagei (Peters, 1870)

One male of this distinctly coppery-red vespertilionid was caught at the University of Ghana Agricultural Research Station at Kpong, near the River Volta, in a mist net set at the edge of a *Gmelina* tree plantation (Table 7). Two females

Table 6.—Selected external and cranial measurements (mm; $\bar{x} \pm SD$ [range]) of *Nycticeinops schlieffeni* and *Scotoecus albofuscus*. Sample sizes are given in parentheses in column headings. Raw measurements are given for samples of 1–2 specimens; summary statistics are limited to ranges for the sample of *S. albofuscus* from Ghana.

Variate	<i>Nycticeinops schlieffeni</i>			<i>Scotoecus albofuscus</i>			
	Ghana		African localities ^a	Ghana			West Africa ^d
	Shai Hills			Shai Hills			
	Males (1) ^b			Males (3) ^d		Females (1) ^e	
Total length	79	—	—	84 ± 1.0 (83–85)	—	—	—
Tail length	33	26–35	—	27.3 ± 2.1 (25–29)	—	—	30–32
Hindfoot length	6	—	—	9 ± 0 (9)	—	—	—
Ear length	11	—	—	12.3 ± 0.6 (12–13)	—	—	—
Mass (g)	5.0	—	—	7.8 ± 1.3 (6.5–9.0)	6.5	—	—
Forearm length	29.2	30.0–33.0	—	29.0 ± 0.6 (28.5–29.7)	30.0	29.8–31.0 (4)	30–31
Condylar-canine length	11.7	—	—	12.5 ± 0.1 (12.4–12.6)	12.3	12.7–13.5 (3)	—
Width across last molar	5.5	5.3–5.9	—	6.4 ± 0.2 (6.2–6.6)	6.5	6.6–6.7 (3)	6.6–6.8
C-M ³	4.5	4.3–4.7	—	4.8 ± 0.1 (4.7–4.8)	4.9	4.7–5.0 (4)	4.9–5.0

^aSpecimen CM 113630.

^bAfter Rosevear (1965).

^cAfter Koch-Weser (1984).

^dSpecimens CM 113637, 113639, and 113640.

^eSpecimen CM 113632.

^fAfter Hill (1974).

Table 7.—Selected external and cranial measurements (ranges) of *Myotis bocagei*, *Glauconycteris variegata*, and *Otomops martiensseni*. Sample sizes are given in parentheses in column headings. Raw measurements are given for samples of 1–2 specimens.

Variate	<i>Myotis bocagei</i>			<i>Glauconycteris variegata</i>			<i>Otomops martiensseni</i>		
	Ghana	West Africa	Ivory Coast	Ghana	West Africa ^a	Ghana	West Africa ^a	East and Central Africa	
	Kpong	(3) ^b	Toyebli	Shai Hills		Pirisi			
	Males (1) ^a		Females (4) ^c	Females (2) ^d		Males (1) ^f			
Total length	95	—	—	90, 106	—	137	—	—	
Tail length	42	36–42	—	35, 45	45–48	40	44–50 ^e	—	
Hindfoot length	10	—	8.0–8.7	8, 10	—	25	—	—	
Ear length	14	—	15.3–16.0	13, 15	—	32	—	—	
Mass (g)	9.5	—	—	7.5, 11.0	9–15 ^e	28	31.0–38.5 ^e	—	
Forearm length	36.8	36.5–38.5	35.6–37.4	41.4, 43.5	41.0–45.5	66.6	62–72 ^e	—	
Condylar-canine length	13.6	—	13.3–14.0	12.9, 13.1	—	—	27.0 ^g	—	
Width across molars	6.0	5.6–5.8	5.7–5.8	6.8, 6.8	6.8–7.0	9.9	—	—	
C-M ³	5.5	5.1–5.5	5.2–5.5	4.5, 4.7	4.6–5.0	9.8	10.8 ^g	—	

^a Specimen CM 113629.
^b After Rosevear (1965).
^c After De Vree (1971).
^d Specimens CM 113628 and MNH 16671.
^e After Kingdon (1974).
^f Specimen USNM 420099.
^g After Hill (1983).

taken at the Saruwi River near Jukwa in the Central Region of Ghana are housed at the USNM (USNM 412115–6) and there is a specimen from Boti Falls, Eastern Region, at the ROM, Canada (W. F. H. Ansell, personal communication). The species has also been reported previously from Borgou, Togo (De Vree and Van der Straeten, 1971); Toyebli, Ivory Coast (De Vree, 1971); and near Harbel, Liberia (Sanborn, 1949).

Glauconycteris variegata (Tomes, 1861)

Two females of this species were caught at the waterhole in the grasslands of the northern Shai Hills Resource Reserve (Table 7). This bat is easily identified by the striking dark, reticulate pattern on its pale-brown wings. Two specimens from Sakpa in the Northern Region and from Odomi Jongo in the Volta Region are housed in the USNM (USNM 420077, 424900). Specimens are also known from Mole National Park, (Hill and Harrison, 1987) and from Gambaga (Ingoldby, 1929), both localities in the Northern Region of Ghana. No other specific localities of specimens from the Accra Plains or elsewhere in Ghana have previously been published.

Family Molossidae

Otomops martiensseni (Matschie, 1897)

This is a large-sized, large-eared, colonial, and cave-dwelling molossid occurring primarily in eastern and southern Africa and Madagascar. It has been reported from the Central African Republic to Djibouti and to Angola and South Africa (Koopman, 1993; Long, 1995).

A single young adult specimen was obtained by Julius C. Geest (USNM 420099) from Pirisi (10°07'N, 2°27'W) in Guinea woodland in the Upper Region of Ghana on 1 March 1968 (Fig. 1; Table 7). In his field notes from 29 February 1968, Geest recorded that this bat was brought to him by a little girl whose "story suggests that it was hanging free in a very large fruit tree among the branches and she knocked it down with a rock. . . . Unfortunately there seems to be a fetish about the bats in the fruit tree." Attempts by him to obtain additional specimens or even visit the tree himself were unsuccessful.

Kingdon (1974:340) described these bats as "built for speed" and that they "should be capable of feeding at considerable distance from their roost." Perhaps this specimen got disoriented by several hundred kilometers from its roost. The closest known record is from Bamingui-Bangoran National Park, Central African Republic (Hill, 1983), a distance of almost 3000 km to the east. Geest's field notes suggested that if *Otomops* occurs regularly in northern Ghana it might be found inside hollow trees or cliffs. The only specimen Verschuren (1957) reported from Garamba National Park, northern Zaire, was, in fact, found in a hollow tree trunk. Few if any caves of any kind occur in the Pirisi area of northern Ghana.

Rodentia

Family Muridae

Myomys derooi Van der Straeten and Verheyen, 1978

A single female of this commensal rodent was trapped in a house in Mamobi, Accra, on 17 June 1992. A male was caught at 1 km S, 4.5 km W Yendi in the Northern Region on 17 November 1991 (Table 8). Although Van der Straeten and Verheyen (1978) reported nine localities from Ghana when they described this

Table 8.—Selected external and cranial measurements (mm; $\bar{x} \pm SD$ [range]) of *Myomys derooi*. Sample sizes are given in parentheses in headings or following ranges. Raw measurements are given for samples of 1–2 specimens.

Variate	Accra and Yendi, Ghana		Togo, Benin, and Ghana (Oda) ^a	
	Females (1), males (1) ^b		Females	Males
Total length	[185], 227		—	—
Tail	[73], 115		116.3 (98.0–135.0) (51)	114.4 (84.0–136.0) (37)
Hindfoot length	21, 20		21.3 (19.5–23.1) (64)	21.5 (19.0–23.1) (42)
Ear	17, 15		14.0 (11.7–16.8) (66)	14.7 (12.0–17.7) (43)
Mass (g)	31, 20		—	—
Condylar-incisive length	26.1, 24.8		—	—
Upper molar row	4.1, 4.0		4.34 (3.95–4.80) (67)	4.35 (4.0–5.1) (n = 43)
Height of braincase	8.1, 7.6		—	—
Intraorbital width	4.4, 4.3		4.2 (3.70–4.95) (n = 67)	4.2 (3.90–4.75) (n = 43)
Zygomatic breadth	13.7, 12.7		12.6 (11.30–13.95) (n = 66)	12.3 (11.25–14.00) (n = 33)

^aSpecimens CM 113707 and 113708.

^bAfter Van der Straeten and Verheyen (1978).

species as separate from *M. daltoni*, only one locality was from the Accra Plains (Achimota). Both of these new specimens display the characteristic "white irregular spot . . . on the chest" and were caught "in human dwelling or in their immediate surroundings" (Van der Straeten and Verheyen, 1978:35).

DISCUSSION

Most of the new distributional records of species reported for the Accra Plains are additional zoogeographical evidence for the presence of Guinea and Sudan savanna faunal elements on the Accra Plains with some additional high forest species. These records support Booth's (1959:35) hypothesis that "the savannah element of the fauna is not a relic, but a group of invading species which has arrived on the Plain from the north and east" and that "the savannah environment may be comparatively new to the Accra Plain, and represents a recent change in vegetation due either to climatic changes or to human activity, or both." Livingstone (1975) described climatic changes in Africa. There have been several moist periods, one prior to 30,000 YBP and another from 12,000 to 7000 YBP. Since 3000 YBP conditions have been dry, probably aggravated by human influences in many areas. Talbot (1981) found additional evidence of drought conditions and dry winds from 4500 to 3800 YBP, based on the presence of an aeolian sand layer and a dune ridge along the coast of the Accra Plains. However, Robbins (1978) argued for a mostly anthropomorphic origin of the savanna vegetation of the Dahomey Gap, the break in the forest zone of West Africa between the Volta and the Niger rivers, on the basis of fertile soils and forest remnants. He concluded (Robbins, 1978:174) that instead of the Dahomey Gap, "both the Volta and Niger rivers have been major factors influencing mammal distribution, with the Niger being the more important (33.4% as opposed to 17.5% for the Volta)."

Dry conditions may have allowed typical Guinea savanna species like *Crociodura lamottei*, and good dispersers like the bats *Eptesicus guineensis*, *E. capensis*, *Nycticeinops schlieffeni*, and *Pipistrellus aegyptius* to reach the Accra Plains from the Guinea savanna via the Dahomey Gap and along the Volta River valley. Moist periods may have caused the expansion of rainforest from the Akwapim escarpment down into the Accra Plains. This may have led to the establishments of species like *Crociodura buettikoferi*, *C. nigeriae*, and *Myotis bocagei* as well as other species caught during this study but not discussed above, such as *Epomops franqueti*, *Myonycteris torquata*, *Hipposideros beatus*, *H. cyclops*, *Glauconycteris poensis*, and *Hylomyscus alleni* (Decher, 1996). These forest species remain today in the extensive dry forests such as Pinkwae Forest and in high forest remnants such as Adumanya Sacred Grove, after the climate became drier, or after land use and deforestation in the surrounding areas increased. The finding of *Otomops* in northern Ghana may be an indication that many bat species and especially those with high aspect ratios, that is the ratio of wingspan squared to wing area (O'Shea and Vaughan, 1980), should be expected to be more widely distributed than conservative estimates from existing localities in central and eastern Africa might indicate.

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APPENDIX

Gazetteer of Collecting Localities from Ghana

BAR = Brong Ahafo Region	NR = Northern Region
CR = Central Region	UWR = Upper West Region
ER = Eastern Region	VR = Volta Region
GA = Greater Accra Region	

Achimota	GA	5°37'N	0°14'W
Adumanya Sacred Grove	GA	5°54'N	0°04'E
Anomabu (or Anamabu Castle)	CR	5°10'N	1°07'W
Bimbila	NR	8°52'N	0°04'E
Boti Falls	ER	6°12'N	0°14'W
Bungweli (Mole National Park)	NR	9°41'N	1°52'W
Doryum (Doyum)	GA	5°54'N	0°01'E
Butre	WR	4°49'N	1°55'W
Gambaga	NR	10°31'N	0°22'W
Kpong Agricultural Research Station	ER	6°08'N	0°04'E
Kokofu	BAR	7°43'N	0°53'W
Kukurantumi	ER	6°12'N	0°22'W
Legon, Botanical Garden	GA	5°40'N	0°12'W
Mamobi, Accra	GA	5°36'N	0°11'W
Odomi Jongo	VR	8°19'N	0°31'E (?)
Pinkwae Dry Forest	GA	5°45'N	0°07'W
Pirisi	UWR	10°07'N	2°27'W
Pulima	UWR	10°51'N	2°03'W
Sakpa	NR	8°52'N	2°21'W
Saruwi River, Jukwa	CR	5°16'N	1°20'W
Shai Hill Resource Reserve, NE ("Pillar 14")	GA	5°57'N	0°04'E
Shai Hills RR, NW	GA	5°53'N	0°03'E
Shai Hills RR, SW	GA	5°57'N	0°04'E
Yendi	NR	9°25'N	0°04'W